BACKGROUND OF THE INVENTION:

This invention relates to a method for reducing capacitance between closely spaced interconnection lines of integrated circuits. The Applicants discovered that several problems arose using "conventional" methods, as shown in Applicant's prior art Fig. 1. One main problem discovered by the Applicants is the lack of adhesion of the cap oxide #8 to the underlying layer of low dielectric constant material #6. Other discoveries by the Applicants were problems with the introduction of reaction gases that include oxygen and nitrous oxide gases prior to a cap oxide deposition. These gases are necessary for reaction chamber stabilization and were found to react with the surface of the low dielectric constant layer, making adhesion of the subsequent cap oxide worse. The present invention solves these problems, as described in Applicant's claims 23, 24, 25, and 27, and outlined in Applicant's Figure 2a-d. The key solution to the various problems was the introduction of an adhesion promoter and stabilizing material, specifically a thin layer of silicon nitride, formed in between the low dielectric layer and the silicon oxide cap layer.

CLAIMS REJECTIONS - 35 USC 103:

Reconsideration of the rejection of Claims 23-25, and 27 under 35 U.S.C. 103(a), as being unpatentable over Jeng et al. (U.S. 6,114,186) in view of You et al. (U.S. 6,197,703) and Lucas (U.S. 6,287,951), is requested, based on the following.

There are patentable differences between the Prior Art cited and the Applicant's invention, namely the following. Note, independent claim 23 has been amended.

The Applicant's curing conditions are not, as taught by Jeng:

" 300 ^{0}C by a hot plate bake ... ". Jeng (col. 4, lines 39-42);

Applicant's amended Claim 23, states low dielectric material curing at 400 ^{0}C.

Also, the Applicant states in amended Claim 23, that silicon nitride is both an adhesion promoter and stabilizing material, not taught by Jeng '186.

The Applicant's stabilizing material is not, as taught by Jeng:

"by plasmas with a thickness of about 1,000-3,000A" Jeng (col. 4, lines 42-60)

Jeng teaches layer #20, "cap layer", or dielectric layer preferably about 1,000 to 3,000 Angstroms in thickness, directly over the HSQ, low dielectric layer. This is a key patentable difference from that of the Applicant's disclosure of a thin silicon nitride adhesion promoter (~200-500 Angstroms in thickness) and stabilizer, directly over the low dielectric layer, formed in between the low dielectric layer and a thick 4,000 to 16,000 Angstrom in thickness oxide cap layer, reference Applicant's amended independent claim 23 and amended claim 25.

The Applicant's invention teaches the following stabilizing material:

The Applicant's amended dependent Claim 25 discloses that the method of independent Claim 23, for the layer of adhesion promoter and stabilizer is: a non-oxide compound, comprising SiN, SiC, BC, BCN, BN, BN, or spun on compounds.

In amended claim 23, the layer of adhesion promoter and stabilizer is silicon nitride, deposited by plasma enhanced chemical vapor deposition to a thickness of between about 200 and

500 Angstroms. Amended claim 25 discloses other compounds for the above comprising SiC, BC, BCN, BN, or spun on compounds.

As stated above, the Applicant's invention teaches PE CVD, as the specific deposition method for the adhesion/stabilizer SiN layer, and the thickness range differs from the prior art. Therefore, the prior art neither teaches nor suggests the Applicant's method.

The Applicant's cap silicon oxide is not:
"cap silicon oxide layer (22) by PECVD with a thickness about 16,000 A"; but, rather specifies a wide thickness range, from 4,000 to 16,000 Angstrom, much more than a 10% difference.

The Applicant's invention teaches a cap silicon oxide:
Claim 27, which depends on independent Claim 23, states,
said silicon oxide cap layer is deposited by plasma enhanced chemical vapor deposition, to a thickness of between about 4,000 to 16,000 Angstroms. This layer is deposited (Claim 23) on the adhesion promoter and over the low dielectric constant material.

In contrast, Jeng et al. teaches, in Col. 4 line 61, "The cap layer 20 may be followed by a thick, about 16,000 A, SiO_2,

interlayer dielectric 22...". This lacks the Applicant's thickness ranges for both SiN layer and cap oxide.

Furthermore, Jeng's teachings have significant differences from that of the Applicant, ref. Jeng, Col. 4 lines 54 and 55, "The thickness of the cap layer is preferably about 1,000 to 3,000 A, and most preferably about 2,000 A."

"You" ('703 B1, Col. 4, lines 8-19) teaches a method of forming by CVD a layer of "capping material" generally SiO, SiN, or SiON, over an HSQ layer.

Lucas et al. (U. S. Patent No. 6,287,951), primarily teaches forming a hardmask and an antireflective layer with silicon nitride, with a totally different application than that taught by the Applicant's claimed invention. The placement in the process for the "Lucas' nitride", is not to be used as a "stabilizer and adhesion promoter" on low dielectric material, as is taught by the Applicant's invention; thus, demonstrating patentable differences. The Lucas disclosure neither teaches nor suggests, the Applicant's claimed invention.

In conclusion, the Applicant's invention is believed to be patentable over prior art references of Jeng, Lucas, and You

because there seems to insufficient basis for concluding that the modification of prior art disclosures to obtain the Applicant's invention, would have been obvious to one skilled in the art. That is to say, there must be something in the prior art or line of reasoning to suggest that the combination of several of these various references is desirable. We believe that there is no such basis for the combination.

The Examiner demonstrates a type of impermissible hindsight, by recognizing the advisability to combine the prior art references only after the Applicants have claimed the combination, as the motivation to combine the references.

Furthermore, at the time of the Claimed Invention, the Applicant's claimed invention was not "obvious to try", and the Applicant's claimed invention produces a synergistic result, that is greater than the sum of the parts, not found in Jeng, You, and Lucas.

In fact, the prior art references actually "teach away" from the Applicant's Claimed Invention, as demonstrated below:
Jeng ('186,) in view of Lucas, does not disclose the thickness of the SiN layer between 200-500 Angstroms, Applicant's amended Claim 23. Jeng ('186) teaches a stabilizing "cap" layer #20,

preferred to be silicon dioxide, which is preferred for low-k silicate dielectrics. Jeng does teach that a SiN layer can be used as a stabilizing layer in certain applications; but, fails to teach that the silicon nitride layer can also be used as an adhesion promoter as well. Jeng's cap layer thickness is different than the Applicant's. "Lucas" does not teach a SiN layer as forming a stabilizing layer, and is mainly concerned with forming a combination of hardmask and ARC, antireflective coating. "You" teaches curing a HSQ layer, which is different than the Applicant's. Furthermore, the Applicant's SiN adhesion/stabilizing layer, coinciding with a low dielectric layer is not sketched the same in any of Lucas' figures.